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INSTRUCTION MANUAL
FOR
MODEL TTS 58AXPJ
and MODEL 58BXPJ
PHASE JITTER
MEASURING SETS

# TTS-58AXPJ/BXPJ

**NORTHEAST ELECTRONICS CORPORATION**
P.O. BOX 649 – CONCORD, N.H. 03301
(603) 224-7466

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FOR
# MODEL TTS 58AXPJ
# and MODEL 58BXPJ
# PHASE JITTER
# MEASURING SETS

ISSUE 2

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# SECTION 1

## DESCRIPTION

1.1 GENERAL DESCRIPTION. The Model 58BXPJ is an accessory unit to be used in conjunction with the Model 58B Impulse Counter and Noise Measuring Set. It mounts in the cover and derives its power from the Model 58B unit. A power cord permanently attached to the Model 58BXPJ is stored in the cord compartment.

1.2 The Model 58BXPJ will measure the peak to peak phase jitter, in degrees of a 1000 Hz signal. The phase jitter is read on a self-contained meter with a $1^{o}$ to $100^{o}$ log scale.

1.3 Input line connections are made to the tip-ring-sleeve binding posts or a jack for a 310 type plug. A DIAL jack and switchable hold coil are provided for dialing through. Line bridging or 750Ω termination is provided. The input is balanced and DC blocked for 100V. A set of binding posts and a jack for a 310 type plug are provided for connecting the Model 58BXPJ output circuit to the Model 58B line input for impulsive phase hit measurement. A conversion chart from dBrn to degrees for phase hits is supplied.

# SECTION 2

## SPECIFICATIONS

TTS 58AXPJ, Model 58BXPJ and Model 58BXPJR

| | |
|---|---|
| INPUT SIGNAL LEVEL REQUIREMENTS: | -30 dBm to +10 dBm |
| INPUT IMPEDANCE: | Terminated, 750 Ω ±10%<br>Bridging ≈ 15KΩ @ 1Khz |
| INPUT BALANCE: | ≥ 70 dB @ 1Khz<br>≥ 90 dB @ 50 Hz |
| INPUT DC BLOCKING: | Input blocked for 100 Vdc |
| HOLD CIRCUIT: | D.C. Resistance approximately 490Ω |
| OPERATING TEST FREQUENCY: | 1000 Hz ± 10% |
| OPERATING TEMPERATURE RANGE: | $0^{\circ}$ C- $50^{\circ}$ C, $32^{\circ}$ F - $120^{\circ}$F |
| METER SCALE CALIBRATION: | Log Scale, $1^{\circ}$ to $100^{\circ}$ peak to peak |
| METER READING ACCURACY: | ± 10% ± $1^{\circ}$ of reading |
| PHASE HITS OUTPUT: | Factory Calibrated for 0.7V peak in 12 kΩ load @ ≈ $50^{\circ}$ peak phase shift, for use with NEC TTS 58A or Model 58B. |
| POWER REQUIREMENTS: | |
| Model TTS 58AXPJ: | 115 VAC -230 VAC, 50 Hz/400Hz approximately 0.4 watts. Approximately 2.5 watts total when supplying power to TTS 58A. |
| Models 58BXPJ and 58BXPJR: | +12 Vdc, +5V dc derived from Models 58B or 58BR. |
| Model TTS 58AXPJ: | TTS 58A Cover Accessory Size: 14" W x 8" H x 4 7/16<br>Weight: 9 pounds |
| Model 58BXPJR: | Rack Mounted Unit<br>Size: 5 7/32" x 19" Rack Panel 6" D<br>Weight: 7 pounds |
| Model 58BXPJ: | Model 58B Cover Accessory<br>Size: 14 ½ W x 9 3/8" H x 4" D<br>Weight: 8.5 pounds |

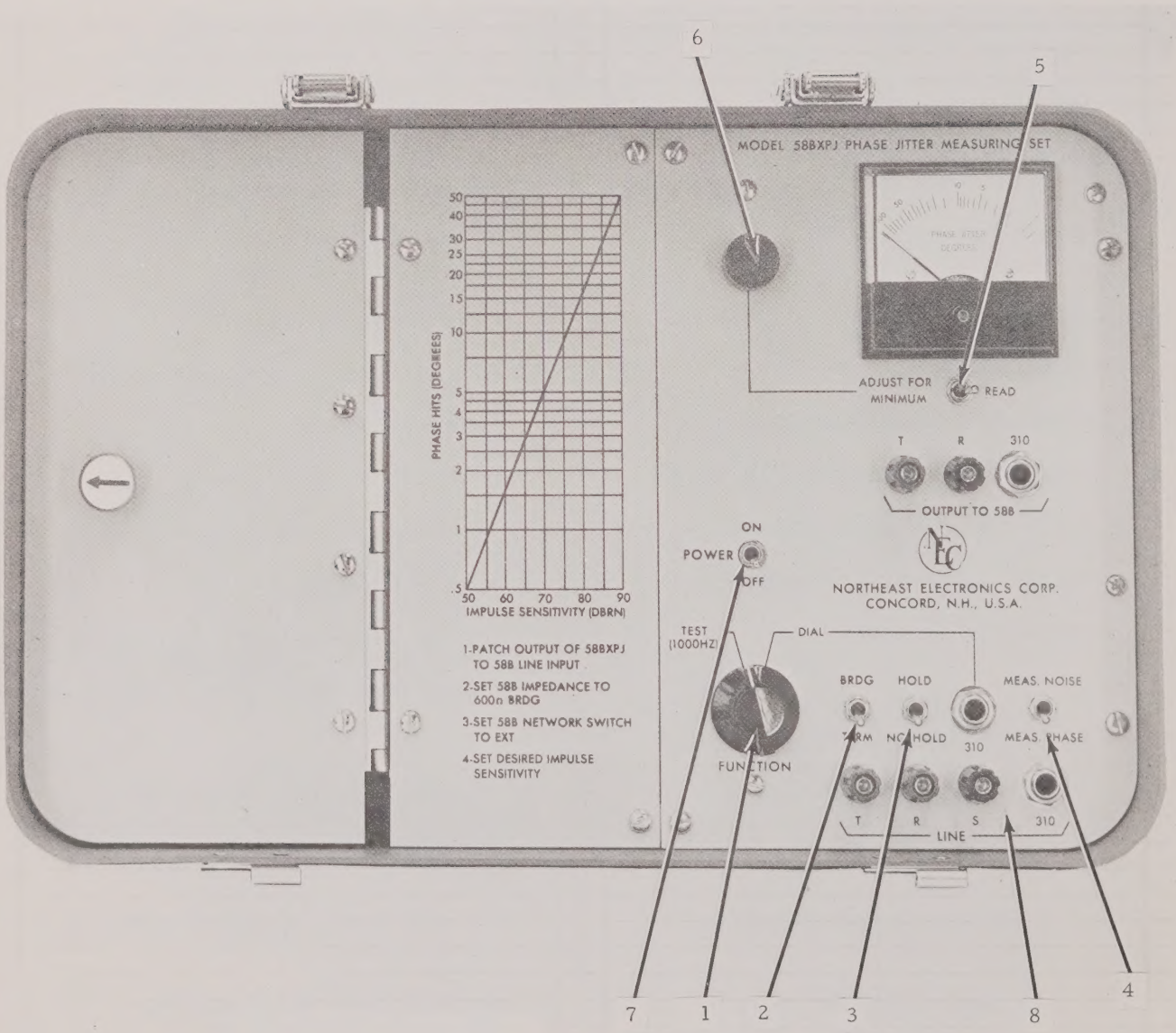



Figure 3-1 Front Panel Controls

# SECTION 3

## OPERATING INSTRUCTIONS

### 3.1 FRONT PANEL CONTROLS (Refer to Fig 3-1).

| Name of Control | Function |
|---|---|
| 1. FUNCTION | Switches the TIP-RING input line terminals to the DIAL jack or to the set input balance transformer. |
| 2. BRDG -TERM | Provides for bridging or terminating a circuit. |
| 3. HOLD-NO HOLD | Provides for connecting a hold coil across the TIP-RING terminals of the incoming line |
| 4. MEAS. NOISE-MEAS. PHASE | Switches the TIP-RING input line terminals to the input circuit of the phase jitter set or to the OUTPUT TIP-RING terminals when in the MEAS-NOISE position |
| 5. ADJUST FOR MINIMUM/READ (SWITCH) | Selects a faster time constant for locking on frequency when in the ADJUST FOR MIN. position. |
| 6 ADJUST FOR MINIMUM (CONTROL) | Provides the means for frequency locking the phase jitter set to the test signal frequency |
| 7. POWER - ON - OFF | Power Switch |
| 8. | Jacks are provided for 310 plugs for the LINE, DIAL and OUTPUT circuits In addition binding posts are provided for the LINE and OUTPUT circuits |

## SECTION 3

### 3.2 OPERATION

a. Model 58BXPJ: Open compartment door and pull out power cord permanently attached to Model 58BXPJ.

b. Model 58BXPJR: Connect and secure connector end of cable to the Model 58BXPJR receptical located on rear. (Cable is supplied with the Model 58BXPJR).

c. TTS 58AXPJ: Connect AC power cord to commercial power outlet.

IMPORTANT

Internal 115/230 V ac selector switch is set to 115 V ac at factory. For 230 V ac operation, set must be removed from case and slide switch activated to desired position.

d. Model 58BXPJ, Model 58BXPJR: Insert 310 plug on other end of cable into 58B jack designated 58BXPJ power. In the case of the Model 58BR, the power jack is available on rear of set as well as on front panel.

e. Turn power switch on.
TTS 58AXPJ: If used with TTS58A Impulse Counter, patch between 310 jack designated TTS 58A power located on TTS 58AXPJ front panel to TTS 58A 310 POWER jack designated -48V POWER. Negative voltage appears on the tip and sleeve is ground in all cases. This feature provides for operating the TTS 58A off commercial power if desired.

f. Apply power to the TTS 58A. Model 58B or Model 58BR. (See Model 58B, Model 58BR or TTS 58A operating instructions.)

3.3 Connect the external line to be tested to the 310 LINE jack or to the TIP-RING-SLEEVE binding post of the phase measuring set.

3.4 If the connection is to be dialed:
a. Connect a dial or tepephone set to the 310 jack designated DIAL.

b. Place FUNCTION switch to DIAL position. (This transfers the LINE terminals to the DIAL jack).

c. Activate toggle switches for desired functions i.e. TERM, HOLD, MEAS. PHASE.

d. Dial the desired number.

e When line connection has been established, place FUNCTION switch to TEST (1000Hz) position.

NOTE:
Test frequency dialed must be 1000Hz ±10%.

f. The dial may now be removed. The internal hold circuit will maintain the connection.

3.5 TO MEASURE PHASE JITTER
a. With the switch in the READ position, slowly rotate the control R30, (located near the meter) over it's entire range until frequency lock is indicated and then carefully adjust for minimum reading. Read phase jitter in peak to peak degrees directly on meter.

NOTE:
Frequency lock is indicated when meter reads on scale.

If unable to adjust for frequency lock, follow steps (b) and (c).

b. With READ switch in the ADJUST FOR MINIMUM position, slowly adjust control for minimum meter reading.

c. Place switch in the READ position and readjust for minimum reading. Read phase jitter in peak to peak degrees directly on meter.

3.6 TO MEASURE PHASE SHIFT DUE TO IMPULSE.

a. Patch cord between phase measuring set TIP-RING binding posts or jack for 310 plug designated OUTPUT and the LINE input of the IMPULSE COUNTER (58B, 58BR, TTS 58A, etc.)

b. TTS 58A: Set front panel controls as follows:

1. INPUT switch set to 600 Ω
2. Place BRDG-TERM switch to BRDG position.
3. WTG switch set to EXT position
4. Connect strap between IN and OUT binding posts
5. Set channels A, B, and C sensitivity controls and main sensitivity control to cover desired span of degrees to be measured. (See Table 3-1)

c. Set Model 58B front panel controls as follows:

1. Turnbutton switch to MEAS. position.
2. Depress pushbuttons for 600Ω BRDG and BAL XFMR.
3. NETWORK switch set to EXT. position.
4. Set BLANKING INTERVAL for desired count rate, between 4 pps to 100 pps.
5. Set SELECTOR switch to Channel A.
6. Set MIN. LEVEL control (IMPULSE NOISE) and INCREMENT control to sensitivity corresponding to desired span of degrees to be measured. (See Table 3-2)

3.7 Adjust for minimum reading as outlined in paragraph 3.5 a. and b. above.

NOTE:
Peak to peak phase jitter reading on meter must be below the span of interest when making phase hits measurements.

TABLE 3-1

| Main Sens. Control | Channel | Sens. Controls | Channel Sens. | Corresponding Phase Hits |
|---|---|---|---|---|
| 70 | C | 10 | 80 dBrn | 16° |
| 70 | B | 6 | 76 dBrn | 10° |
| 70 | A | 0 | 70 dBrn | 5° |

TABLE 3-2

| Min. Level (Impulse Noise dBrn) | Increment Thresh. Level | Channel Sens. | Corresponding Phase Hits |
|---|---|---|---|
| 70 | 12 | D-82 dBrn | 20° |
| 70 | 8 | C-78 dBrn | 12.5° |
| 70 | 4 | B-74 dBrn | 8° |
| 70 | 0 | A-70 dBrn | 5° |

3.8

a. Set IMPULSE COUNTER TIMER to desired time in minutes.

b. On the Model 58B, immediately and momentarily depress the COUNT/RESET key switch to RESET position. For the TTS 58A, reset all three mechanical counters. This resets all counters to 0 and establishes the start of the test.

3.9

a. At the end of test, when timer has returned to 0, record individual readings accumulated on mechanical counters on TTS 58A. For example: (See Table 3-3) Readings indicate that 122 phase hits due to impulse noise exceeded 5° phase shift but were less than 10°. 50 phase hits exceeded 10° but were less than 16°. 2 phase hits were greater than 16°.

b. In the case of the Model 58B, set SELECTOR switch to each channel and record individual readings For example: (See Table 3-4). Readings indicate a total of 112 hits due to impulse noise and resulted in phase shifts equal to or greater than 5°; 82 of these were equal to or greater than 8°; 25 were equal to or greater than 12.5° and 6 were equal to or greater than 20°.

c. To by-pass phase measuring set to measure IMPULSE NOISE or CIRCUIT NOISE with 58B or TTS 58A, place MEAS NOISE/MEAS PHASE toggle switch in MEAS NOISE position. This connects the external line directly to the IMPULSE COUNTER LINE input.

TABLE 3-3

| Main Sens. Control | Channel | Sens. Controls | Cha. Sens. | Readings (Phase Hits) | Corres. Phase Hits |
|---|---|---|---|---|---|
| 70 | C | 10 | 80 dBrn | 2 | 16° |
| 70 | B | 6 | 76 dBrn | 50 | 10° |
| 70 | A | 0 | 70 dBrn | 122 | 5° |

TABLE 3-4

| Min. Level Impulse Noise | Increment Thresh, Level | Channel Sens. | Readings (Phase Hits) | Corres. Phase Hits |
|---|---|---|---|---|
| 70 | 12 | D-82 dBrn | 6 | 20° |
| 70 | 8 | C-78 dBrn | 25 | 12.5° |
| 70 | 4 | B-74 dBrn | 82 | 8° |
| 70 | 0 | A-70 dBrn | 112 | 5° |

# SECTION 4

## CIRCUIT DESCRIPTION

4.1 The 1kHz signal connected to the input is ac coupled by transformer T-1. The secondary is connected to a low-pass filter and the input signal subsequently applied to the AMP-LIMITER (U1, Q1 and Q2).

4.2 The waveform at the output of the AMP-LIMITER is a rectangular pulse and is applied to a divide by two, ($\frac{1}{2}$ U2). The complimentary outputs of the divide by two are connected to two separate phase shift detectors.

4.3 A local oscillator with a frequency twice that of the incoming input signal is connected to a divide by two, ($\frac{1}{2}$U2) with it's complimentary outputs, in turn, applied to two other divide by two intergrated circuits (U3).

4.4 One half of U3 provides a signal in quadrature with the input signal to the phase detector enclosed in the lock loop. The output signal is averaged, filtered, amplified and the resulting signal used to control the local voltage controlled oscillator. The response of the lock loop is essentially speeded up when switch S-7 is in the ADJ. FOR MINIMUM position. This fast response facilitates locking the local oscillator to the input signal frequency.

4.5 With switch S-7 in the READ position, the lock loop response is slow enough to allow measurement of phase jitter with low modulation frequencies. Typically as low as 10 Hz.

4.6 The other half of U3 is connected to the other phase detector . The width of the rectangular pulse appearing at the output of this phase detector varies with the phase shift of the incoming signal. This pulse is applied to a circuit which converts the pulse width variations to peak amplitude variations (Q10 and Q11). waveshape appearing at the output of the pulse width to amplitude modulation converter is sawtooth in nature and is applied to a buffer circuit Q13 providing an output signal for phase hits detection.

4.7 This same sawtooth is also applied to a peak detector ($\frac{1}{2}$U6), with the resulting output dc. component applied to the D. C. Log converter, ($\frac{1}{2}$U6, Q6 and Q7). The dc output of the log converter is applied to a dc amplifier (U7), driving the meter.

4.8 The transistors Q8, Q9, Q16, and Q17 constitute a phase correction detector circuit providing for the correct polarity at the output of the PHASE DETECTOR CIRCUIT ($\frac{1}{2}$U4).

# SECTION 5

## MAINTENANCE AND CALIBRATION

5.1 MAINTENANCE. The schematics block diagram and printed circuit board diagrams identify circuit components. Waveforms and voltages appear on the schematic diagrams. Components are identified by letter symbols according to the following convention:

| | |
|---|---|
| C | capacitor |
| CR | diode |
| E | printed circuit board |
| J | jack or connector |
| L | inductor |
| Q | transistor |
| R | resistor |
| S | switch |
| T | transformer |
| U | intergrated circuit |

5.2 MALFUNCTIONS. In the event of a malfunction ensure that:

a). The power cord is properly connected to available power.

b). All external line plugs are properly wired and inserted in the correct jacks.

c). All switchs and controls are set in accordance with the OPERATION section of this manual.

d). The test being performed is within the specifications limit of the instrument.

5.3 When it has been determined that a malfunction does exist, proceed as follows

a). Switch off power to the set and remove power cord.

b). If TTS 58AXPJ, remove (11) 6-32 screws and carefully withdraw entire set from cover.

c). If Model 58BXPJ; remove (4) 6-32 screws securing main front panel. Carefully withdraw set from cover.

d). Re-connect power cord and switch on power when needed.

e). Use the following table on page 5-2 as a guide for localizing problem area.

5.4 **CALIBRATION; If calibration is** found to be necessary, it is recommended that customer return the set to the factory for recalibration.

NOTE

Replacement of the intergrated circuits U6 or U8 would require factory recalibration.

## TROUBLESHOOTING TABLE

| SYMPTOM | PROBABLE CAUSE |
|---|---|
| 1). Meter remains at mechanical zero setting when power is applied. (Pilot Lamp is on in TTS 58AXPJ) | Power Supply failure. Check power supply voltages for +5VDC and +12 VDC. Check CR-5. If TTS 58AXPJ; check T-2, CR-106 U101, and U102, check Q101 and Q102. |
| 2). If TTS 58AXPJ; Pilot Lamp does not light when power is applied. | Power Supply failure. Check fuse F-1, power switch, S-3 and 115/230 VAC selector switch S-6. |
| 3). Unable to get meter to read on scale. (Indicates $> 100^{o}$) | Loss of test signal or local osc. failure. Use oscilloscope to observe waveforms at indicated points outlined in Fig. 5-1 in order to localize problem area. Logic waveforms indicated are for properly operating set. |
| 4). Unable to get meter to read on scale. Indicates $\ll 1^{o}$ with no input signal. | Check transistor circuits associated with U8 and U9. Follow same procedure as outlined in 3 above. |
| 5). No signal at output of PHASE HITS terminals. | Check Q13 and associated circuitry. |

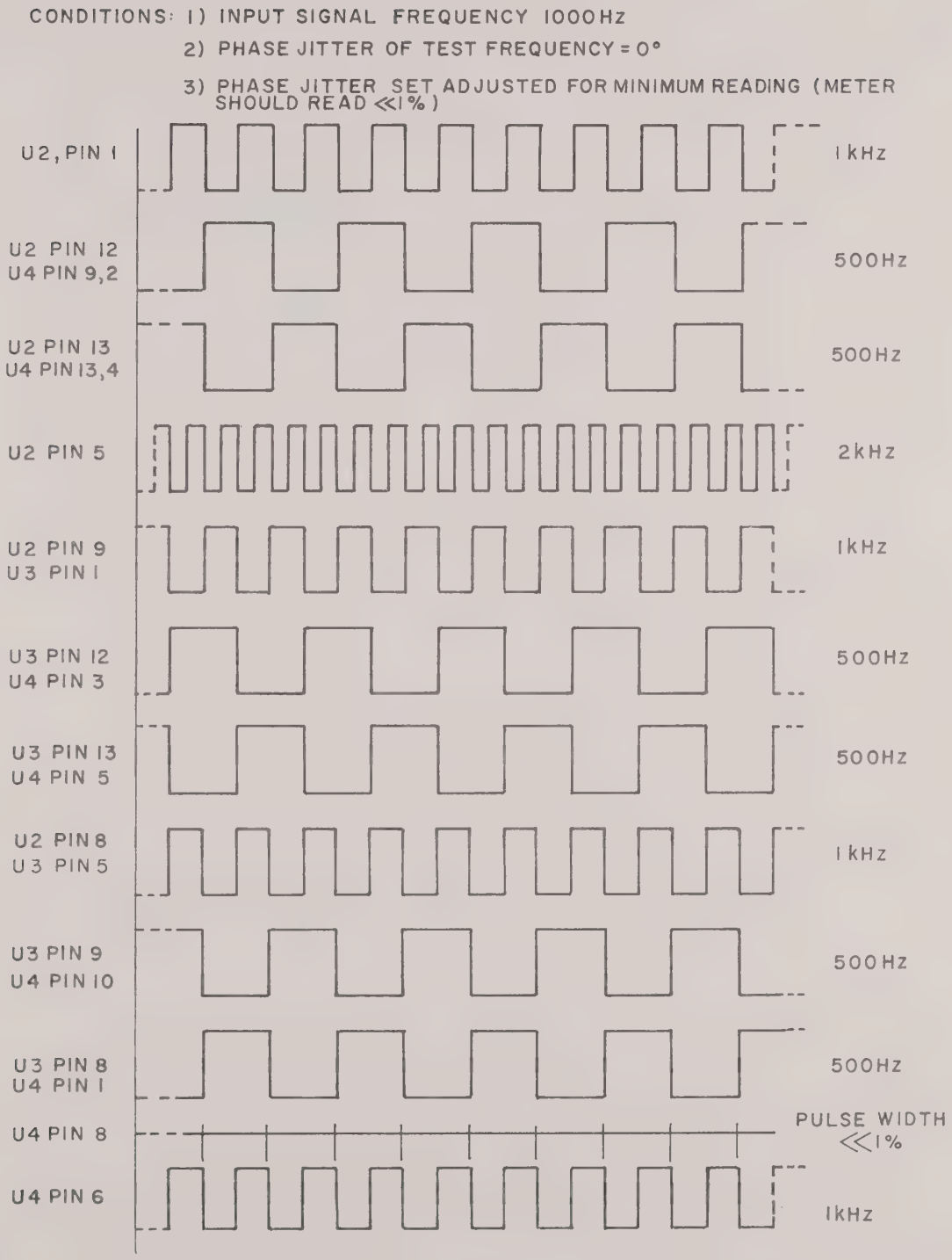



Fig. 5-3 Relative Logic Waveforms At Indicated Points

# SECTION 6

## ELECTRONIC PARTS LIST

6.1 INTRODUCTION. The following pages contain the parts list for the TTS 58AXPJ and Model 58BXPJ.

6.2 FSCM Code Numbers. This is the Federal Supply Code of Manufacturers as issued October 1969. A list of codes and their respective manufacturers is given on page 6-2.

## LIST OF MANUFACTURERS

| Code No. | Manufacturer |
|---|---|
| 01121 | Allen-Bradley, Milwaukee, Wis. 53204 |
| 01295 | Texas Instruments Inc. Semiconductor Div., Dallas, Tex. 75231 |
| 02567 | International Electronic Industries, Nashville, Tenn. 37204 |
| 05397 | Union Carbide, "Kemet", N.Y., N. Y. 10017 |
| 06486 | IRC Division of TRW, Lynn, Mass. 01905 |
| 06555 | Beede Electrical Instrument Co. Penacook, N.H. 03301 |
| 12065 | Transitron Electric Corp., Boston, Mass. 02128 |
| 12954 | Dickson Electronics Corp., Scottsdale, Ariz. 85252 |
| 13606 | Sprague Electric Cp., Concord, N. H. 03301 |
| 15873 | Motorola Inc., Arcade, N. J. 14009 |
| 17117 | Electronic Moulding Corp., Pawtucket, RI. 02860 |
| 17538 | Precision Electronics, Mansfield, Mass. 02050 |
| 17803 | Fairchild, Semiconductor Div., Mountain View, Calif. 94041 |
| 22650 | Whale Electronics, Nashville, Tenn. 37204 |
| 44655 | Ohmite Mfg. Co., Skokie, Ill. 60076 |
| 49671 | RCA Corp., N.Y., N. Y. 10020 |
| 71450 | CTS Corp., Elkhart, Ind. 46514 |
| 71590 | Centralab, Milwaukee, Wis. 53201 |
| 71744 | Chicago Miniture Lamp, Chicago, Ill. 60640 |
| 72765 | Drake Manfacturing, Hawood Heights, Ill. 60656 |
| 75915 | Littelfuse Inc., Des Planes, Ill. 60016 |
| 80223 | United Transformer Co., N.Y., N. Y. 10013 |
| 80368 | Sylvania Electric Inc., N.Y., N. Y. 10017 |
| 82389 | Switchcraft Inc., Chicago, Ill. 60630 |
| 84432 | Newton Engineering, Newton, Mass. 02161 |
| 94322 | Tel&Labs Inc., Manchester, N.H. 03102 |

PD&E Assoc., Waltham, Mass., ( No FSCM code number listed)

MAIN ASSEMBLY

| Ref. Desig. | Description | Manufacturer (FSCM Code#) | Part Number |
|---|---|---|---|
| T1 | Transformer, input | 80223 | A-20 or GR-815 |
| T2* | Transformer, power | 17538 | NEC-2 |
| L1 | Hold coil | 86632 | TN1274 |
| S1 | S: | 71590 | PA-1002 |
| S2 | S: | 09353 | 7101 |
| S3, S4 | S: | 09353 | 7201 |
| S5 | S: | 09353 | 7401 |
| S6* | S: | 82389 | 46206LF |
| S7 | S: | 09353 | 7101 |
| J1, J2 | Jack | 82389 | L12B |
| J3, J4 | Binding post | 17117 | 5595-175-2 |
| J5 | Binding post | 17117 | 5595-175-0 |
| J6 | Jack | 82389 | L12B |
| J7 | Binding post | 17117 | 5595-175-2 |
| J8 | Binding post | 17117 | 5595-175-0 |
| J9* | Jack | 82389 | L12B |
| J10* | AC receptacle | 82389 | AC3G |
| F1* | Fuse 1/10A Slo-Blow | 75915 | MDL 1/10 |
| DS-1* | Pilot light (neon) | 72765 | HR118T-603 |
| M-1 | Meter | 06555 | Model 204 |
| R1, R2 | R: 383Ω $\frac{1}{2}$W 1% | 06486 | CECTO |
| R30 | Pot. 250K 30% | 71450 | 5VA-45 |
| C28 | C: 300μF 3V | 02567 | APD081 |
| C1 | C: 2.2μF 100V | 22650 | 51-6838 |
| LP-1 | Neon Lamp | 71744 | NE-2 |

* TTS 58AXPJ only.

Printed Circuit Board E-14-038 53-008

| Ref Desig. | Description | Manufacturer (FSCM Code#) | Part Number |
|---|---|---|---|
| R101 | R: 100Ω 3W | 13606 | 242E1015 |
| R102 | R: 1500Ω ¼W ±10% | 01121 | CB |
| R103 | R: 470Ω ¼W ±10% | 01121 | CB |
| R104 | R: 4.53K 1/8W ±1% | 06486 | CEATO |
| R105 | R: 2200Ω ¼W ±10% | 01121 | CB |
| R106 | Pot., 2K | 71450 | UPE200RE1 |
| R107 | R: 5.49K 1/8W +1% | 06486 | CEATO |
| R108 | R: 250Ω 2watt | 13606 | 240E251J |
| R109 | R: 2000Ω 1/8W ±1% | 06486 | CEATO |
| R110 | Pot: 2K | 71450 | UPE200RE1 |
| R111 | R: 9.09 K1/8W ±1% | 06486 | CEATO |
| R112 | R: 1500Ω ¼W ±10% | 01121 | CB |
| R113 | R: 470Ω ¼W ±10% | 01121 | CB |
| R114, R115 | R: 2.49K 1/8W ±1% | 06486 | CEATO |
| C101, C102 | C: 250μF 50V | 13606 | 39D257G050HE4 |
| C103 | C: 0.005μF 50V | 71590 | CK-502 |
| C104 | C: 200 pF 1KV | 71590 | DD-201 |
| C105 | C: 250μF 50V | 13606 | 39D257G050HE4 |
| C106 | C: 0.005μF 50V | 71590 | CK-502 |
| C107 | C: 200pF 1KV | 71590 | DD-201 |
| C108 | C: 100μF 20V | 02567 | APD-095 |
| CR101, CR102 | Diode | 12065 | 1N4148 |
| CR103 | Diode, zener, 6.2V ±5% | 12954 | 1N823 |
| CR104, CR105 | Diode | 12065 | 1N4148 |
| CR106 | Diode, package | PD&E | NSS3058A |
| Q101, Q102 | Transistor NPN | 49671 | 2N2102 |
| U101, U102 | Intergrated circuit | 01295 | SN72709 |

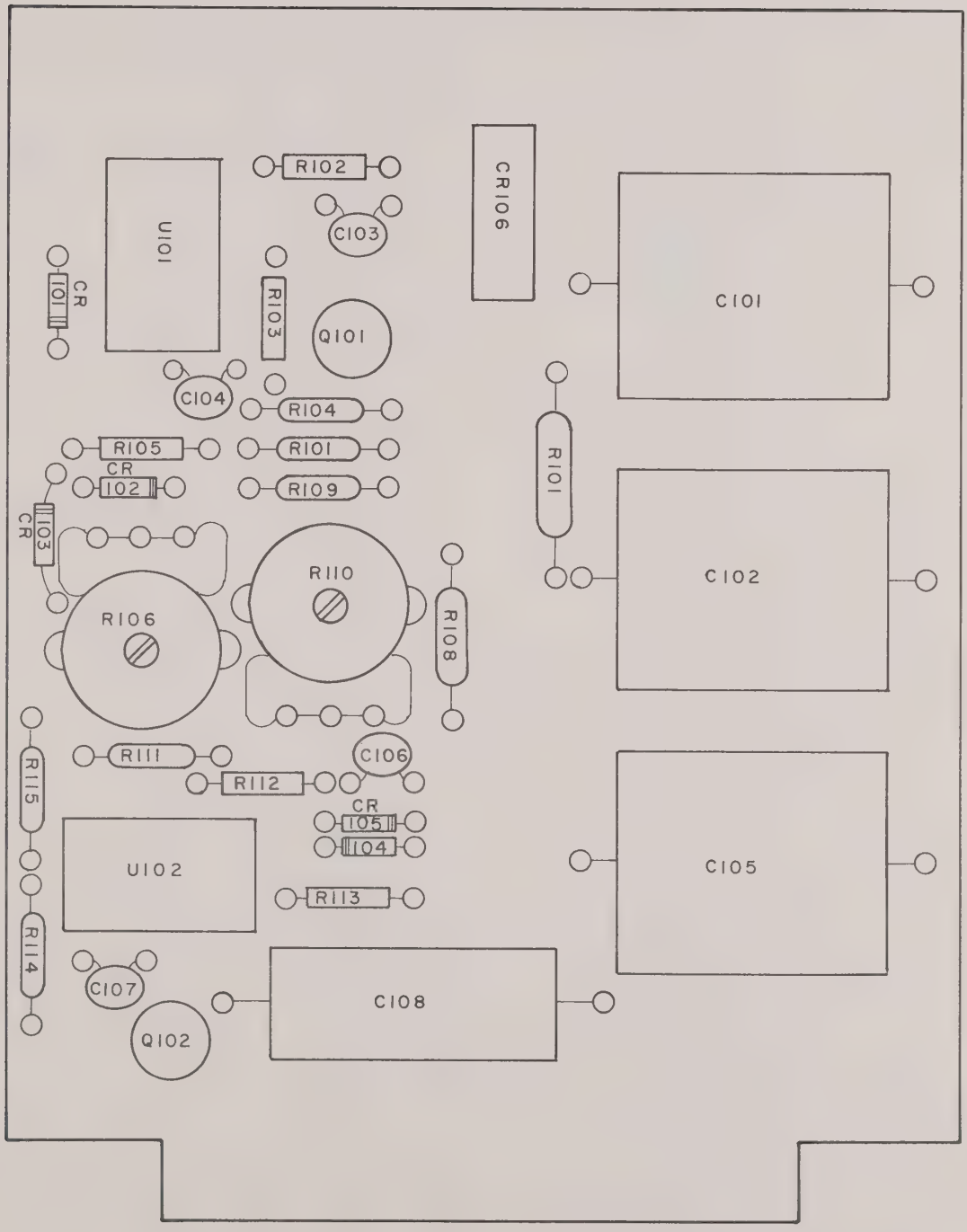



Figure 6-1 Component Location E-14-038-53-008

Printed Circuit Board E95634

| Ref Desig. | Description | Manufacturer (FSCM Code No.) | Part Number |
|---|---|---|---|
| R3 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R4,R5 | R: 1M $\frac{1}{4}$W 10% | 01121 | CB |
| R6 | R: 1.5K $\frac{1}{4}$W 10% | 01121 | CB |
| R7 | R: 1.8K $\frac{1}{4}$W 10% | 01121 | CB |
| R8 | R: 220Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R9 | R: 100K $\frac{1}{4}$W 10% | 01121 | CB |
| R10 | R: 1K $\frac{1}{4}$W 10% | 01121 | CB |
| R11 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R12 | R: 27Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R13 | R: 1K $\frac{1}{4}$W 10% | 01121 | CB |
| R14 | R: 220Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R15,R16 | R: 110 K1% 1/8W | 06486 | CEATO |
| R17 | R: 33Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R18 | R: 33K $\frac{1}{4}$W 10% | 01121 | CB |
| R19 | Pot., 50K 10% | 06486 | 500 Series |
| R20 | R: 180Ω $\frac{1}{2}$W 1% | 94322 | CR-16 |
| R21 | Pot., 100Ω 10% | 06486 | 500 Series |
| R22 | R: 3.3 K $\frac{1}{4}$W 10% | 01121 | CB |
| R23 | R: 1.5K $\frac{1}{4}$W 10% | 01121 | CB |
| R24 | R: 10K 1/8W 1% | 06486 | CEATO |
| R25 | Pot., 50K 10% | 06486 | 500 Series |
| R26 | R: 4.7K $\frac{1}{4}$W 10% | 01121 | CB |
| R27 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R28,R29 | R: 15K $\frac{1}{4}$W 10% | 01121 | CB |
| R31 | R: 390K $\frac{1}{4}$W 10% | 01121 | CB |
| R32 | R: 15K $\frac{1}{4}$W 10% | 01121 | CB |
| R33 | R: 22K $\frac{1}{4}$W 10% | 01121 | CB |
| R34 | R: 100K $\frac{1}{4}$W 10% | 01121 | CB |
| R35 | R: 1.5K $\frac{1}{4}$W 10% | 01121 | CB |
| R36 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R37,R38 | R: 5.6K $\frac{1}{4}$W 10% | 01121 | CB |
| R39 | R: 560Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R40 | R: 2.2K $\frac{1}{4}$W 10% | 01121 | CB |
| R41,R42 | R: 30.1K 1/8W 1% | 06486 | CEATO |
| R43 | R: 2.2K $\frac{1}{4}$W 10% | 01121 | CB |
| R44,R45 | R: 100K $\frac{1}{4}$W 10% | 01121 | CB |
| R46 | R: 22K W10% | 01121 | CB |
| R47 | R: 33K $\frac{1}{4}$W 10% | 01121 | CB |
| R48 | R: 27Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R49 | R: 560Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R50 | R: 10Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R51 | R: 39K $\frac{1}{4}$W 10% | 01121 | CB |
| R52 | R: 47K $\frac{1}{4}$W 10% | 01121 | CB |
| R53 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R54 | R: 1.5K $\frac{1}{4}$W 10% | 01121 | CB |
| R55 | R: 7.5K 1/8W 1% | 06486 | CEATO |
| R56 | Pot. 2K 10% | 06486 | 500 Series |
| R57 | Pot., 5K 10% | 06486 | 500 Series |

Printed Circuit Board E95634 (cont)

| Ref Desig. | Description | Manufacturer (FSCM Code #) | Part Number |
|---|---|---|---|
| R58,R59 | R: 100K $\frac{1}{4}$W 10% | 01121 | CB |
| R60 | R: 470Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R61 | R: 680Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R62,R63,R64 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R65 | Pot., 50K 10% | 06486 | Series 500 |
| R66 | R: 1 M $\frac{1}{4}$W 10% | 01121 | CB |
| R67,R68,R69 | R: 1K $\frac{1}{4}$W 10% | 01121 | CB |
| R70 | R: 6.19K ±1% 1/8W | 06486 | CEATO |
| R71,R72,R73,R74 | R: 22K $\frac{1}{4}$W 10% | 01121 | CB |
| R75 | R: 100Ω $\frac{1}{4}$W 10% | 01121 | CB |
| R76 | R: 10K $\frac{1}{4}$W 10% | 01121 | CB |
| R77 | R: 22K $\frac{1}{4}$W 10% | 01121 | CB |
| R78 | R: 27K $\frac{1}{4}$W 10% | 01121 | CB |
| C2 | C: 0.47μF 25V | 13606 | 5C11 |
| C3,C4 | C: 0.005μF 50V | 71590 | CK-502 |
| C5 | C: 200 pF 1KV | 71590 | DD-201 |
| C6 | C: 22μF6V | 05397 | K22W6K |
| C7 | Not used | | |
| C8 | C: 8.2μF 15V | 05397 | K8R2W15K |
| C9 | C: 0.01μF 50V | 71590 | CK-103 |
| C10 | C: 0.005μF 50V | 71590 | CK-502 |
| C11 | C: 200 pF 1KV | 71590 | DD-201 |
| C12 | C: 1.0μF 25V | 13606 | 5C13 |
| C13 | C: 0.005μF 50V | 71590 | CK-502 |
| C14 | C: 200 pF 1KV | 71590 | DD-201 |
| C15 C15A | C: 1.0μF 25V | 13606 | 5C13 |
| C16 C16A | C: 22μF 6V | 05397 | K22W6K |
| C17,C18 | C: 0.01μF 100V | 13606 | 225P |
| C19,C20 | C: 0.0056μF 100V | 13606 | 225P |
| C21 | C: 0.47μF 25V | 13606 | 5C11 |
| C22,C23 | C: 100μF 15V | 13606 | TE-1162 |
| C24 | C: 0.47μF 25V | 13606 | 5C11 |
| C25 | C: 15μF 10V | 05397 | K15W10K |
| C26 | C: 0.0082 100VDC 10% | 13606 | 225P |
| C27 | C: 0.47μF 25V | 13606 | 5C11 |
| C29 | C: 0.47μF 25V | 13606 | 5C11 |
| C30 | C: 22μF 6V | 05397 | K22W6K |
| C31 | C: 0.082μF 35V | 05397 | KR082W35K |
| C32 | C: 3.3μF 25V | 05397 | K3R3W25K |
| C33 | C: 10 pF 1KV | 71590 | DD-100 |
| C34 | C: 82 pF 1KV | 71590 | DD-820 |
| U1 | Intergrated circuit | 01295 | SN72709 |
| U2,U3 | Intergrated circuit | 01295 | SN7473N |
| U4 | Intergrated circuit | 01295 | S7451N |
| U5 | Intergrated circuit | 01295 | SN72709 |
| U6 | Intergrated circuit | 17803 | μA739C |
| U7 | Intergrated circuit | 01295 | SN72709 |
| U8 | Intergrated circuit | 49671 | CA3046 |

Printed Circuit Board E95634 (cont)

| Ref Desig. | Description | Manufacturer (FSCM Code#) | Part Number |
|---|---|---|---|
| U9 | Intergrated circuit | 49671 | CA3046 |
| Q1 | Transistor | 15873 | 2N3903 |
| Q2 | Transistor | 15873 | 2N3905 |
| Q3 | Transistor | 15873 | MPS-6515 |
| Q9 | Transistor | 01295 | 2N1375 |
| Q11 | Transistor | 15873 | 2N3905 |
| Q14, Q15 | Transistors | 49671 | 2N2102 |
| Q16 | Transistor | 15873 | MPS-6515 |
| Q17 | Transistor | 15873 | MPS-6519 |
| Q18 | Transistor | 15873 | MPS-6515 |
| CR1 thru CR4 | Diode | 12065 | 1N4148 |
| CR5 | Diode | 80368 | 1N2069 |

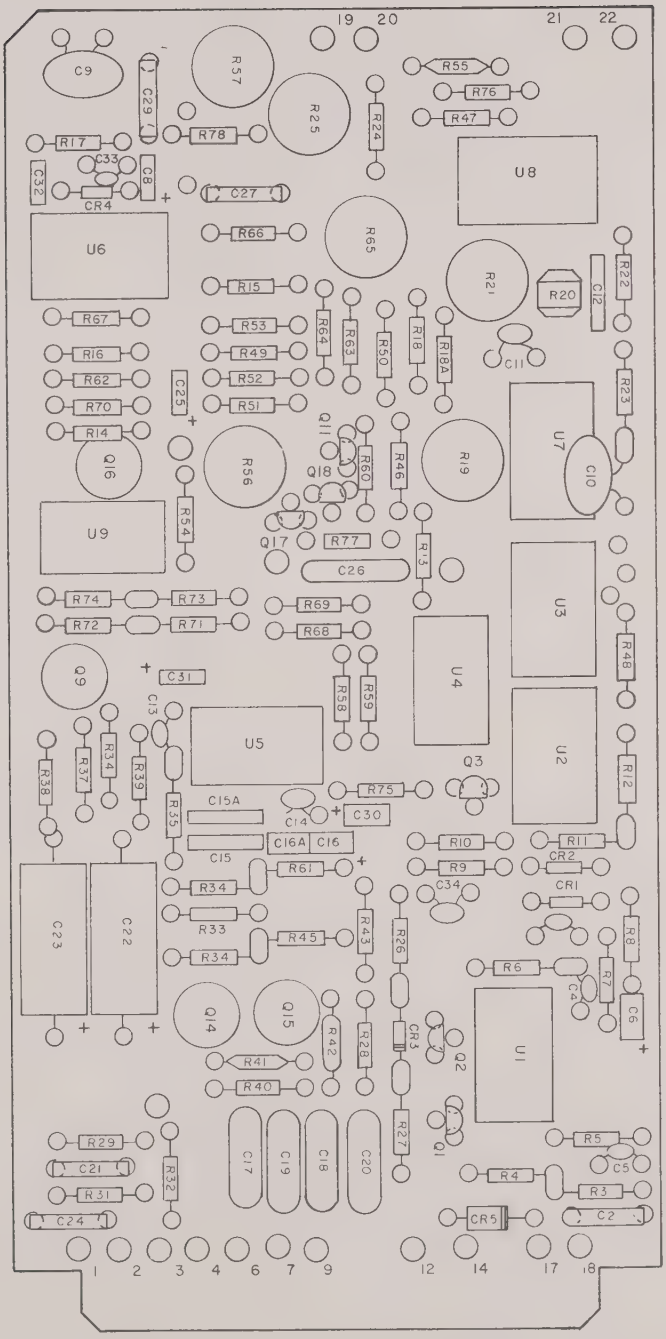



Figure 6-2 Component Location E95634

# SECTION 7

## SCHEMATIC DIAGRAMS

7.1 INTRODUCTION. The following pages contain the schematic diagrams for the TTS 58AXPJ and Model 58BXPJ.

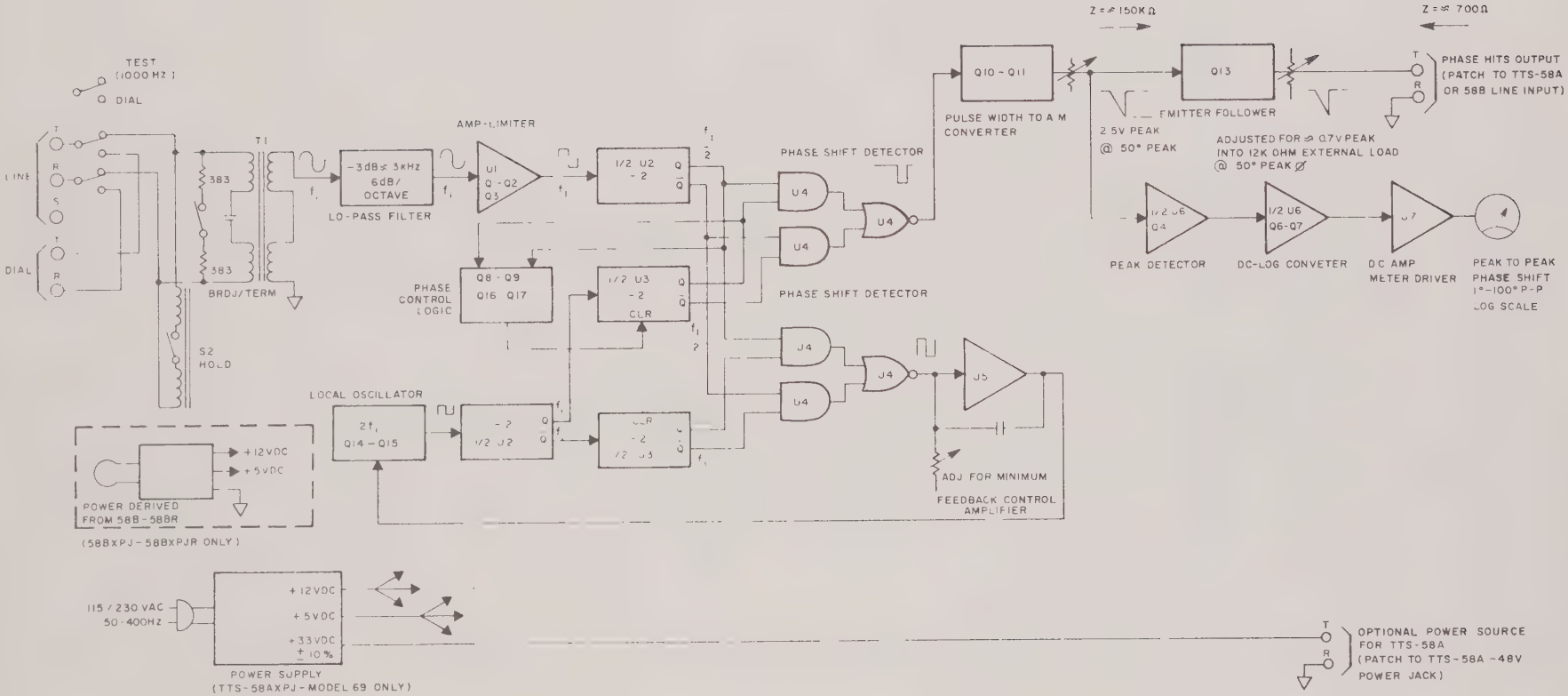
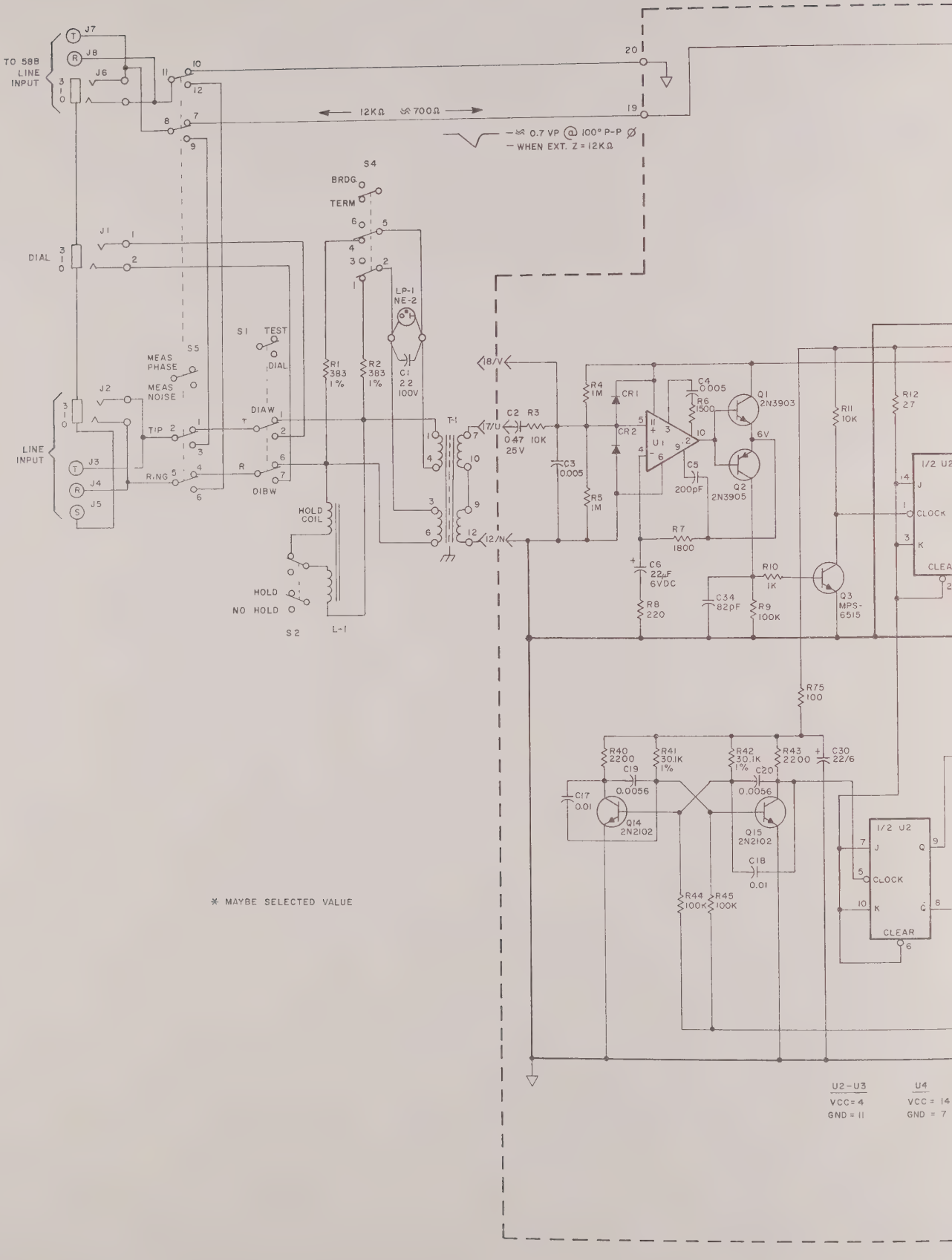



Figure 7-1 TTS 58AXPJ and Model 58BXPJ Block Diagram.




* MAYBE SELECTED VALUE

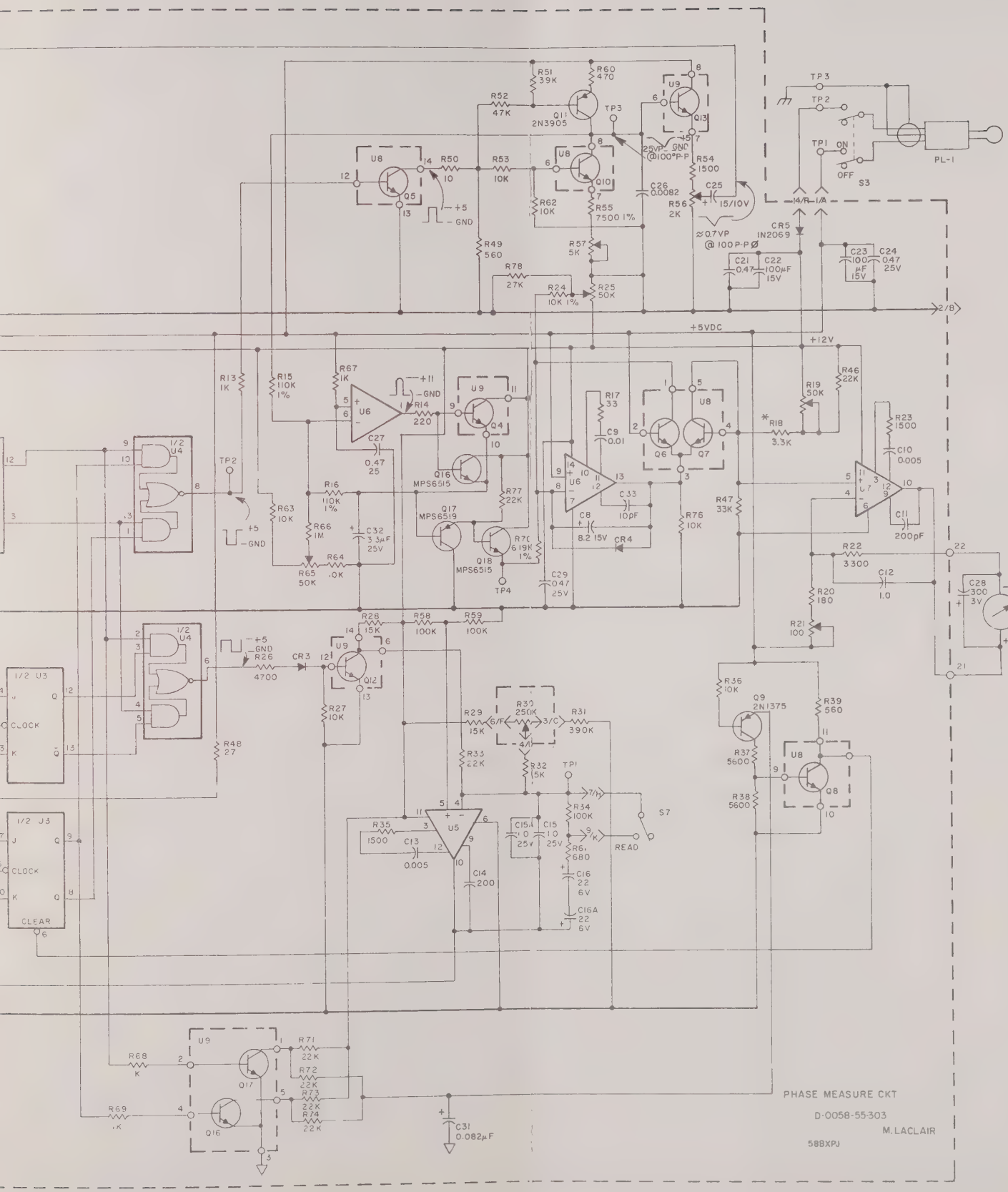



Figure 7-2 TTS 58AXPJ and Model 58BXPJ Schematic Diagram.

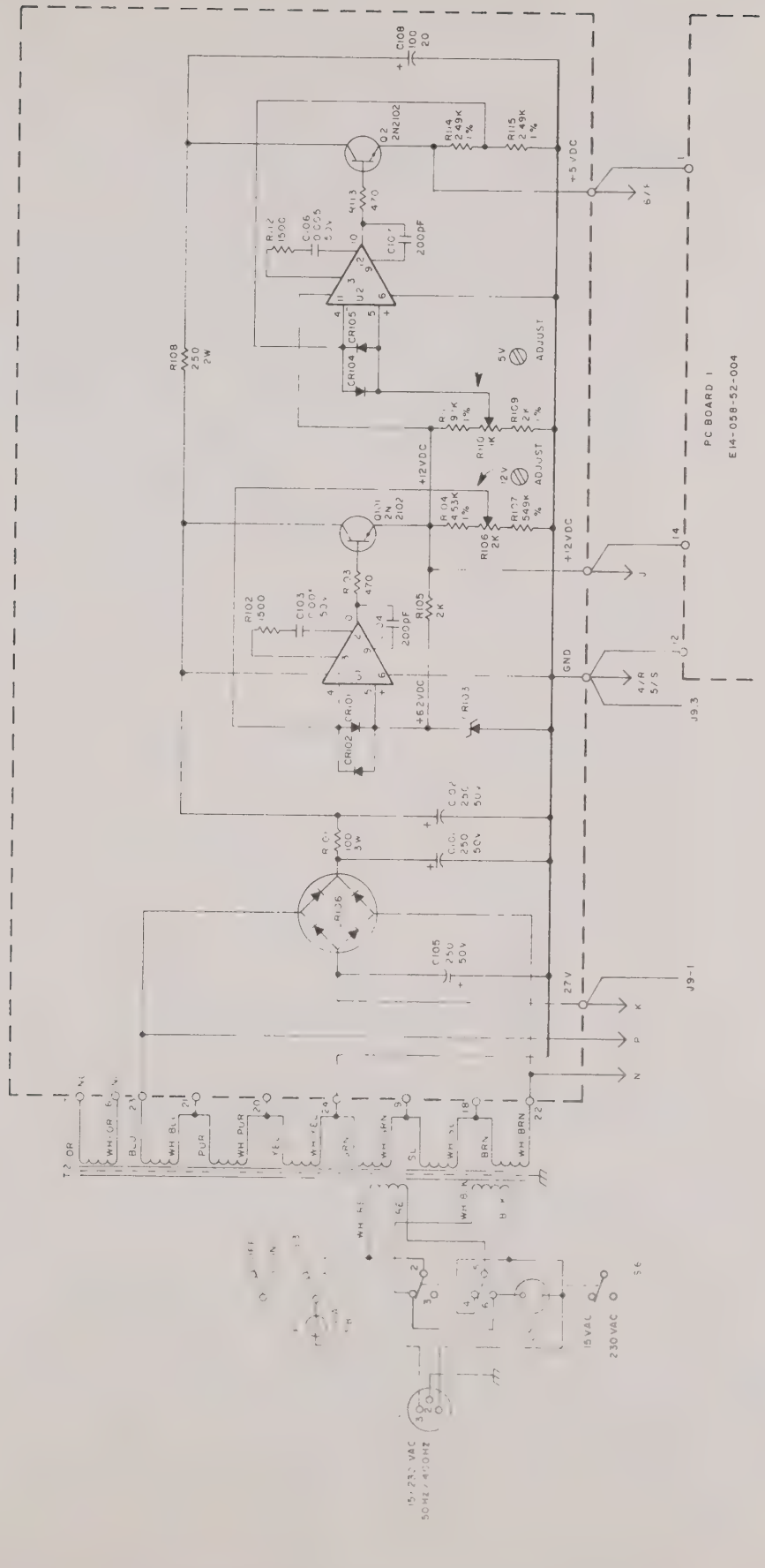



Figure 7-3 TTS 508AXPJ Power Supply Schematic Diagram.

# MODELS 58BXPJ/58BXPJF CALIBRATION PROCEDURE

## 1.0 EQUIPMENT NEEDED

2 NEC Model TTS 43A Oscillators or equivalent.
1 Hp 400FL VTVM or equivalent.
1 Triplett VOM Model 630NA or equivalent.
1 NEC Model 58B (Power source, +5 VDC; +12 VDC)
1 Oscilloscope
1 Attenuator, Daven Model VH795G or equivalent.
(attenuator impedance must be 600 ohms in and out)

## 2.0 PRELIMINARY CHECK AND SET-UP

### 2.1 D.C. VOLTAGE CHECK

a. Remove 58BXPJ/F unit from cover, and connect power cord to 58B.

b. Apply power to the Model 58BXPJ/F.

c. With VOM measure +5 Vdc ± .1 Vdc at pos. terminal of C-23 and +11.2 Vdc ± .2 Vdc at pos. terminal of C-22. Connect VOM common lead to negative terminal of C-22.

### 2.2 OSCILLATOR ADJUSTMENTS

a. See Figure 1 on page 6. (Model 58BXPJ/F must be terminating).

b. Remove oscillator No. 2 from the circuit and replace with a precision 600 ohm load.

c. Adjust oscillator No. 1 frequency to 1 kHz ± 2 Hz, and the output level to .775 VRMS.

NOTE: .775 VRMS into 300 ohm load establishes a reference level of 0 dB to which the output level of oscillator No. 2 will be adjusted.

d. Remove the 600 ohm resistor and replace oscillator No. 2 into circuit. (see Figure 1)

e. Remove oscillator No. 1 from circuit and replace with the 600 ohm precision resistor.

f. Adjust oscillator No. 2 frequency to 1100 Hz ± 2 Hz and the output level corresponding to the desired phase jitter as listed in table below.

i.e.: Phase jitter desired, 100° P-P. Adjust level for -1.29 dB ± .2 dB.

| Oscillator No. 2 Level | Phase Jitter ($^{o}$P-P) |
|---|---|
| -35.16 dB ± .2 dB | $2^{o}$ P-P |
| -21.19 dB ± .2 dB | $10^{o}$ P-P |
| -1.29 dB ± .2 dB | 100$^{o}$ P-P |

g. Adjust oscillator No. 2 output level to -1.29 dB ± .2 dB.

h. Remove 600 ohm resistor and replace oscillator No. 1 into circuit. (See Figure 1)

IMPORTANT: If major re-calibration is required, (which would probably be the case if U6, U7 and/or U8 have been replaced). Preset calibration controls R19, R21, R25, R56, R57 and R65 to mid-range.

To check calibration only proceed directly to section 3.0.

## 2.3 PHASE LOCKING 58BXPJ/F

a. Set up 58BXPJ/F as follows:

Terminate.
No hold.
Function switch in test position.
Adjust/read switch in adjust position.

b. With circuit configuration as shown in Figure 1, disable oscillator No. 2 by switching power off.

NOTE: Output impedance of the Model TTS 43A oscillator will not be affected by removing power at indicated operating levels above. If in doubt, replace with 600 ohm resistor when using other types of oscillators.

c. Connect high side of scope to TP3, (Junction of C7, C26 and R15). Low side to ground.

d. Adjust R-30 (adjust for min. potentiometer) located on 58BXPJ/F front panel for LOCK condition, as indicated by an "ON SCALE" reading of the meter.

e. Place ADJUST FOR MIN./READ switch to the READ position.

f. Continue to adjust control for minimum peak level indication of the waveform displayed on scope.
NOTE: Increase scope sensitivity to maximum.
Correct adjustment of R30 is attained when scope display is a straight line.

## 2.4 D.C. NULL ADJUSTMENT

a. Connect high side of VOM to TP-4, (Junction of R-70 and Q18 emitter). Low side to ground.
NOTE: VOM adjusted for 6V full scale.

b. Adjust R65 for a minimum DC voltage indication on VOM. (approximately 5.5 Vdc ± .25 volts).

## 2.5 P.M. to A.M. CONVERTER ADJUSTMENT

a. Re-apply power to oscillator No. 2. (or remove 600 ohm resistor and place oscillator No. 2 in circuit whichever is the case).

b. Connect high side of scope to TP3, low side to ground. (see Figure 2)

c. While observing the longest spike, adjust R-57 for 2.8V peak ± .1 volt.

d. Secure potentiometers R65 and R57 with glyptol or other adhesive.

## 3.0 CALIBRATION CHECK AND PROCEDURE

## 3.1 $2^{\circ}$ ADJUSTMENT

a. Substitute a 600 ohm precision resistor for oscillator No. 1. (see Figure 1).

b. Adjust oscillator No. 2 output level for -35.16 dB ± .2 dB. (corresponds to $2^{\circ}$ P-P phase jitter)

c. Replace oscillator No. 1 in circuit. (remove 600 ohm resistor)

d. Place ADJUST FOR MIN./READ switch in the READ position.

e. Slowly and carefully rotate R-30 from a completely CCW position until an "ON SCALE" reading is obtained. Carefully adjust for a minimum reading. Meter should indicate a $2^{\circ}$ reading ± $.2^{\circ}$.

f. If calibration is required adjust R-25 for $2^{\circ}$ ± $.2^{\circ}$ reading.

## 3.2 $100^{\circ}$ ADJUSTMENT

a. Substitute a 600 ohm precision resistor for oscillator No. 1. (see Figure 1).

b. Adjust oscillator No. 2. Output level for -1.29dB ± .2dB. (corresponds to $100^{\circ}$ P-P phase jitter )

c. Replace oscillator No. 1 into the circuit. (remove 600 ohm resistor).

d. Wait 15 seconds while observing meter on 58BXPJ/F. Meter should read 100° phase jitter when phase lock occurs. If phase lock is not indicated, repeat step 3.1 e. Meter should read 100° P-P phase jitter ± 10°.

e. If calibration is required, adjust R-19 for 100° P-P phase jitter ± 5°.

3.3 10° ADJUSTMENT

a. Substitute a 600 ohm precision resistor for oscillator No. 1. (see Figure 1)

b. Adjust oscillator No. 2 output level for -21.19 dB ± .2 dB. (corresponds to 10° P-P phase jitter)

c. Replace oscillator No. 1 into the circuit. (remove 600 ohm resistor)

d. If phase lock is not indicated within 15 seconds, repeat step 3.1 e.

e. Meter should read 10° P-P phase jitter ± 1°.

f. If calibration is required , adjust R-21 for a 10° ± 1° reading on meter.

NOTE: Some inter-action between R19, R21 and R25 will necessitate repeating section 3.0 for desired accuracy. When desired accuracy has been attained glyptol R19, R21 and R25.

4.0 PHASE HITS CALIBRATION

4.1 EQUIPMENT SET UP

A. Connect equipment as indicated in Figure 1, page 6.

B. Patch from the Ring and Tip output terminals of the MODEL 58BXPJ/F to the Ring and Tip line terminals of the Model 58B.

C. Set up 58B as follows:

1. Power - on
2. Timer - cont.
3. Range - X100
4. Blank Int. - 100
5. Selector - Channel B
6. Minimum Level - 60 dBrn
7. Increment - 6-10-14-18
8. Impedance - 600 Brdg.
9. Bal. Xfmr. - in
10. No Hold

D. Connect the shorting bar between the IN and OUT EXT NETWORK bridging posts of the MODEL 58B.

E. Oscillator Adjustments

1. Oscillator No. 1 should be set for 0 dBm into 300 ohms at 1 kHz.

2. Substitute a 600 ohm precision resistor for oscillator No. 1.

3. Adjust oscillator No. 2 output level for -21.19 dB ± .2 dB. (corresponding to $10^{\circ}$ P-P phase jitter)

4. Replace oscillator No. 1 into the circuit. (remove 600 ohm resistor)

5. If phase lock is not indicated within 15 seconds slowly and carefully rotate R-30 from a completely CCW position until an "on scale" reading is obtained. Carefully adjust for a minimum reading.

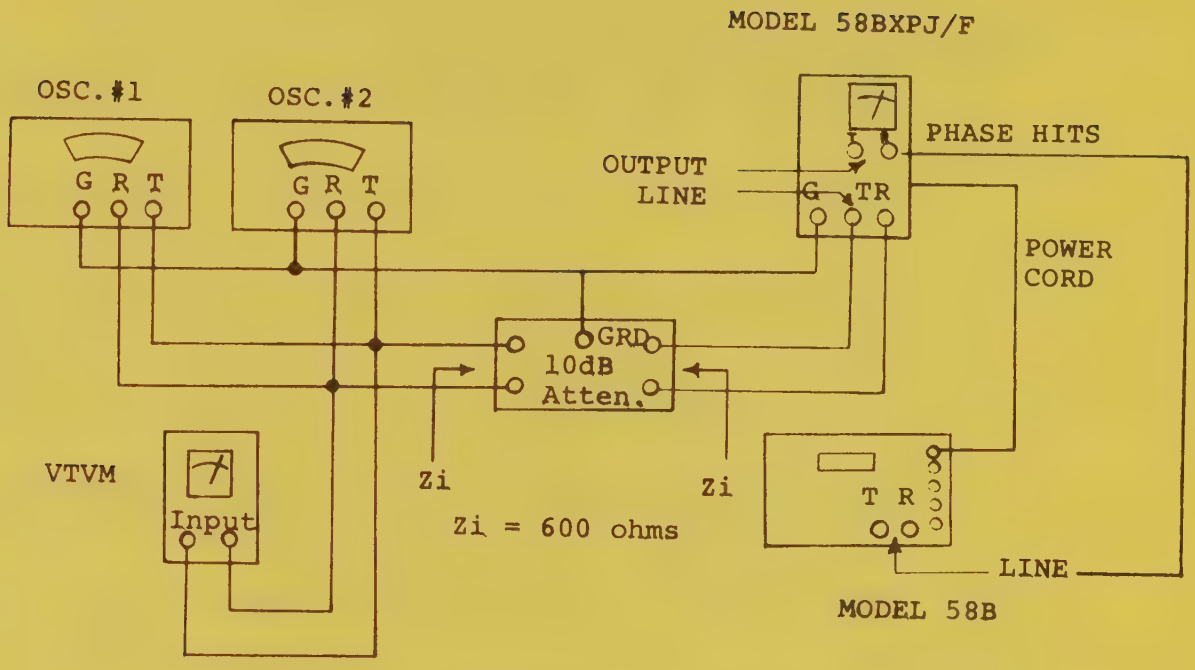
6. Meter should read $10^{\circ}$ P-P phase jitter ± $1^{\circ}$.

## 4.2 CALIBRATION

A. Adjust R-56 on the Model 58BXPJ/F for visual counting just at the point of threshold as observed on the Model 58B.

B. Secure R-56 with glyptol or other adhesive.

FIGURE 1




EQUIPMENT SET-UP

OSCILLATOR 1

Source Impedance = 600 ohms

Frequency = 1 kHz ± 2 Hz

Level = .775 VRMS (Reference level)

OSCILLATOR 2

Source Impedance = 600 ohms

Frequency = 1100 Hz ± 2 Hz

Level = as indicated in table on page 2.

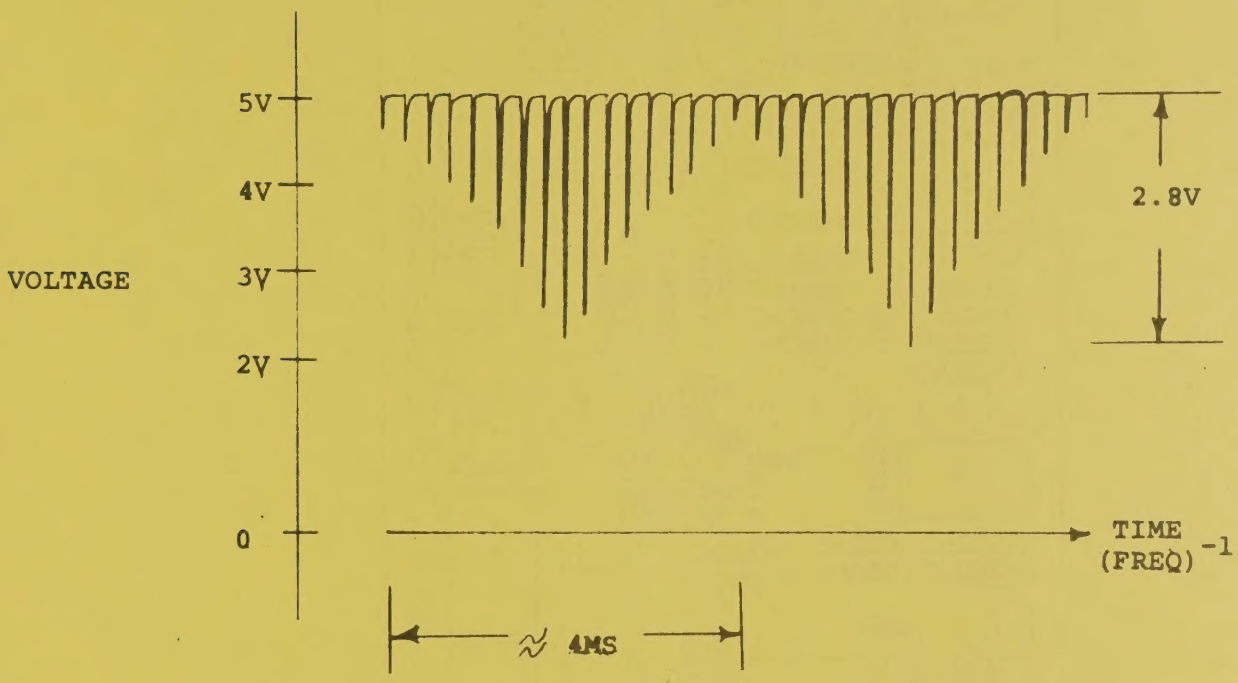
NOTE: Oscillator levels are adjusted for indicated levels into a 300 ohm load by removing the other oscillator from the circuit and replacing it with a 600 ohm precision load.

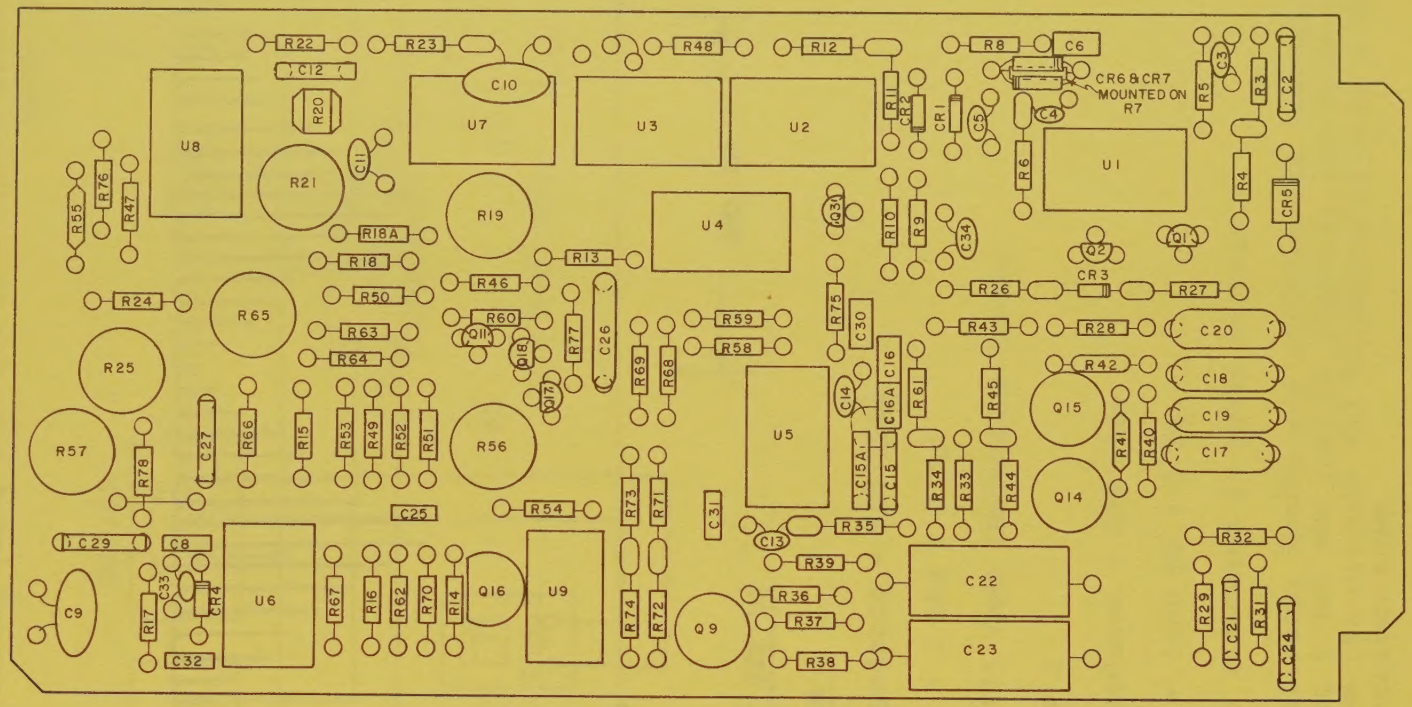
MODEL 58BXPJ/F

Set BRDG/TERM switch to TERM position

FIGURE 2

(Waveform at T.P. 3 at 100° P-P phase jitter)




R22
R23
C12
C10
U7
U3
U2
R48
R12
R8
C6
CR6 & CR7
MOUNTED ON
R7
U8
R20
C11
R21
R19
U4
U1
R18A
R18
R13
R46
R50
R60
R63
R64
R24
R65
R25
R57
R78
C27
R66
R15
R53
R49
R52
R51
R56
C25
R54
C29
C8
C9
C33
C4
R17
C32
U6
R67
R16
R62
R70
R14
Q16
U9
R74
R72
Q9
R73
R71
C31
C26
R77
R69
R68
R59
R58
U5
R75
C30
C14
C16A
C16
R61
C15A
C15
R34
R33
R44
R45
C13
R35
R39
R36
R37
R38
C22
C23
R11
CR2
CR1
C5
R6
R10
R9
C34
Q31
Q2
Q1
CR3
R26
R27
R43
R28
R42
Q15
Q14
R41
R40
C20
C18
C19
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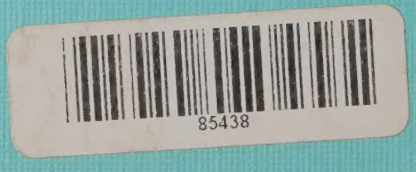
R55
R47
R5
R3
C3
C2
R4
CR5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